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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/520,816

01/07/2005

Susumu Matsumoto

71971-109

4853

20277 7590 05/07/2007
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EXAMINER

MATTHEWS, COLLEEN ANN

ART UNIT

PAPER NUMBER

2811

MAIL DATE

DELIVERY MODE

05/07/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/520,816

Applicant(s)

MATSUMOTO ET AL.

Examiner

Colleen A. Matthews

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2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 February 2007.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 02/28/2007 has been entered.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 11, 13, 14 and 15 are rejected under 35 U.S.C. 102(a) as being anticipated by Applicant's Admitted Prior Art (AAPA) of Figure 3 and 4a-4f and specification pages 27-32.

Regarding claim 11, AAPA discloses an electronic device comprising: a low dielectric constant film (24) having a hole (26), a first nitrogen-non-containing insulating film (21) formed under the low dielectric constant film, a second nitrogen-non-containing

insulating film (25) formed over the low dielectric constant film, where a trench (27), which is connected with the hole, is formed in the second nitrogen-non-containing insulating film and at least an upper portion of the low dielectric constant film and the bottom of the trench is located in the middle portion of the low dielectric constant film.

Regarding claim 13, AAPA discloses the device of claim 11, where the upper surface of the low dielectric constant film (24) is in contact with the lower surface of the second nitrogen-non-containing insulating film (25).

Regarding claims 14-15, AAPA discloses the device of claim 11, where the low dielectric constant film is a carbon-containing silicon oxide film or a porous film or SiOC film (spec page 27 lines 21-22).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6 and 8-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pub. No. 2003/0001273 to Steiner et al. (Steiner) in view of applicant's Admitted Prior Art (AAPA).

Regarding claim 1, Steiner discloses an electronic device comprising: a low dielectric constant (Figure 6 42, paragraph 19 lines 20-21) film having a hole (90) and a trench (82) formed in at least an upper portion of the low dielectric constant film to be

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connected with the hole, a nitrogen-non-containing insulating film (36, paragraph 22) formed under the low dielectric constant film, and a nitrogen-containing insulating film (30, paragraph 20 lines 4-8) formed under the nitrogen-non-containing insulating film, wherein a bottom of the trench is located in the middle portion of the low dielectric constant film (the trench, 82, is shown in Figure 6 in the middle portion of two separate portions of the dielectric film 42).

Stiener fails to disclose the bottom of the trench located in the middle portion of the vertical direction of the dielectric film. AAPA discloses a device including a low dielectric constant film (Figure 3 element 24) and a trench (27) where the bottom of the trench is located in the middle portion of the vertical direction of dielectric film. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Steiner to the bottom of the trench located in the middle portion of the vertical direction of the dielectric film as in the AAPA in order to provide metal interconnects for connection to other circuitry.

Regarding claim 2, Steiner discloses the device of claim 1, where the hole passes through the nitrogen-non-containing insulating film and the nitrogen-containing insulating film. Steiner lacks disclosing the device further including a lower-level interconnect which is located under the hole and connected with the hole, and the upper surface of the lower-level interconnect, except for a region in which the lower-level interconnect is connected with the hole, is covered with the nitrogen containing insulating film.

The AAPA discloses a device including a lower-level interconnect (22) which is located under the hole (27) and connected with the hole, and the upper surface of the lower-level interconnect, except for a region in which the lower-level interconnect is connected with the hole, is covered with the insulating film (23).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Steiner to include a lower-level interconnect under the hole as in the AAPA in order to provide electrical connection to other circuitry.

Regarding claim 3, Steiner discloses the device of claim 1, where the lower surface of the low dielectric constant film (42) is in contact with the upper surface of the nitrogen-non-containing insulating film (36).

Regarding claim 6, Steiner discloses an electronic device comprising: a low dielectric constant film (42, paragraph 19 lines 20-21) having a hole (90), a nitrogen-non-containing insulating film (48, paragraph 22) formed over the low dielectric constant film, and a nitrogen-containing insulating film (54) formed over the nitrogen-non-containing insulating film, wherein a trench (82), which is connected to the hole, is formed in the nitrogen-containing insulating film (30), the nitrogen-non-containing insulating film (36), and at least an upper portion of the low dielectric constant film (42) and a bottom of the trench is located in the middle portion of the low dielectric constant film (the trench, 82, is shown in Figure 6 in the middle portion of two separate portions of the dielectric film 42).

Stiener fails to disclose the bottom of the trench located in the middle portion of the vertical direction of the dielectric film. AAPA discloses a device including a low

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dielectric constant film (Figure 3 element 24) and a trench (27) where the bottom of the trench is located in the middle portion of the vertical direction of dielectric film. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Steiner to the bottom of the trench located in the middle portion of the vertical direction of the dielectric film as in the AAPA in order to provide metal interconnects for connection to other circuitry.

Regarding claim 11, Steiner discloses an electronic device comprising: a low dielectric constant film (42, paragraph 19 lines 20-21) having a hole (90), a first nitrogen-non-containing insulating film (36, paragraph 22) formed under the low dielectric constant film, a second nitrogen-non-containing insulating film (48, paragraph 22) formed over the low dielectric constant film, where a trench (82), which is connected with the hole, is formed in the second nitrogen-non-containing insulating film and at least an upper portion of the low dielectric constant film and the bottom of the trench is located in the middle portion of the low dielectric constant film (the trench, 82, is shown in Figure 6 in the middle portion of two separate portions of the dielectric film 42).

Regarding claims 4-5, 9-10 and 14-15, Steiner discloses the device of claims 1, 6 and 11, where the low dielectric constant film is a carbon-containing silicon oxide film or a porous film (paragraph 19 lines 20-21). Steiner further discloses the carbon-containing silicon oxide film as a SiOC film (paragraph 19 lines 20-21).

Regarding claim 8, Steiner discloses the device of claim 6, where the upper surface of the low dielectric constant film (42) is in contact with the lower surface of the nitrogen-non-containing insulating film (48).

Regarding claim 12, Steiner discloses the device of claim 11, where the lower surface of the low dielectric constant film (42) is in contact with the upper surface of the first nitrogen-non-containing insulating film (36).

Regarding claim 13, Steiner discloses the device of claim 11, where the upper surface of the low dielectric constant film (42) is in contact with the lower surface of the second nitrogen-non-containing insulating film (48).

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pub. No. 2003/0001273 to Steiner et al. (Steiner) in view of applicant's Admitted Prior Art (AAPA) and U.S. Pub. No. 2002/0102779 to Yang.

Regarding claim 7, Steiner as modified discloses the device of claim 6. Steiner lacks disclosing the nitrogen-containing insulating film is an anti-reflection film.

Yang teaches a nitrogen-containing insulating film (Fig 2F element 210, paragraph 21) as an anti-reflection film formed over a dielectric film. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Steiner to have the nitrogen-containing insulating film as an anti-reflection film as in Yang in order to limit reflection during patterning.

Claims 16-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pub. No. 2005/0098896 to Huang et al. (Huang).

Regarding claim 16, Huang discloses an electronic device comprising: a low dielectric constant film (Fig 3 element 306a) having a hole (346a), and a low density

insulating film (308a/312a) having a film density of 1.3 g/cm or lower (paragraph 24 lines 16-21) and formed over the low dielectric constant film, where a trench (348a), which is connected with the hole, is formed in the low density insulating film and at least an upper portion of the low dielectric constant film is filled with an interconnect and a bottom of the trench is located in low dielectric constant film.

Huang fails to disclose the bottom of the trench located in the middle portion of the vertical direction of the dielectric film. AAPA discloses a device including a low dielectric constant film (Figure 3 element 24) and a trench (27) where the bottom of the trench is located in the middle portion of the vertical direction of dielectric film. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Huang to the bottom of the trench located in the middle portion of the vertical direction of the dielectric film as in the AAPA in order to provide metal interconnects for connection to other circuitry.

Regarding claim 17, Huang as modified discloses the device of claim 16, as above. Huang lacks teaching the low density insulating film containing Nitrogen. AAPA teaches an insulating film containing Nitrogen (spec page 27 lines 19-20). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Huang to have the low density insulating film contain Nitrogen as in AAPA to utilize etch chemistries for nitrogen layers.

Regarding claim 18, Huang discloses the device of claim 16, further comprising a nitrogen-containing insulating film (Fig 3 element 304a, paragraph 37 lines 1-3 and paragraph 20 lines 4-5) formed under the low dielectric constant film.

Regarding claims 19-20, Huang as modified discloses the device of claim 16, as above, Huang lacks teaching the low dielectric constant film as carbon-containing silicon oxide film, where it is a SiOC film, or a porous film. AAPA teaches a low dielectric constant film as SiOC (spec page 27 lines 21-22). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Huang to have the low dielectric constant film as SiOC as in AAPA in order to provide device performance improvements such as reducing propagation delay and therefore improving speed.

Response to Arguments

Applicant's arguments filed 02/28/2007 have been fully considered but they are not persuasive.

Applicant argues with regard to claims 1, 6, 11 and 16 that the prior art does not disclose a bottom of a trench located in the middle portion of the vertical direction of the low dielectric constant film, however this feature is shown in the AAPA of Figure 3. Applicant's amendment necessitated an updated rejection outlined above. In light of the updated rejection, applicant's arguments are moot.

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colleen A. Matthews whose telephone number is 571-272-1667. The examiner can normally be reached on Monday - Friday 8AM-4:30PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on 571-272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CAM
04/25/2007


Sara Crane
Primary Examiner